Carbon Markets

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Carbon – Credit Trading: how did it arise?

Current legislation and regulatory measures to reduce atmospheric concentrations of greenhouse gases have their roots in climate change challenges presented by the United Nations Framework Convention on Climate Change and the Kyoto Protocol. Although the United States has not signed the Kyoto Protocol, many state and regional initiatives have been developed to reduce atmospheric concentrations of greenhouse gases (Figure 1), as well as voluntary markets such as the Chicago Climate Exchange (http://www.chicagoclimateexchange.com/). Other exchanges are being planned for the future, for example the California Climate Exchange and The Green Exchange (by NYMEX).

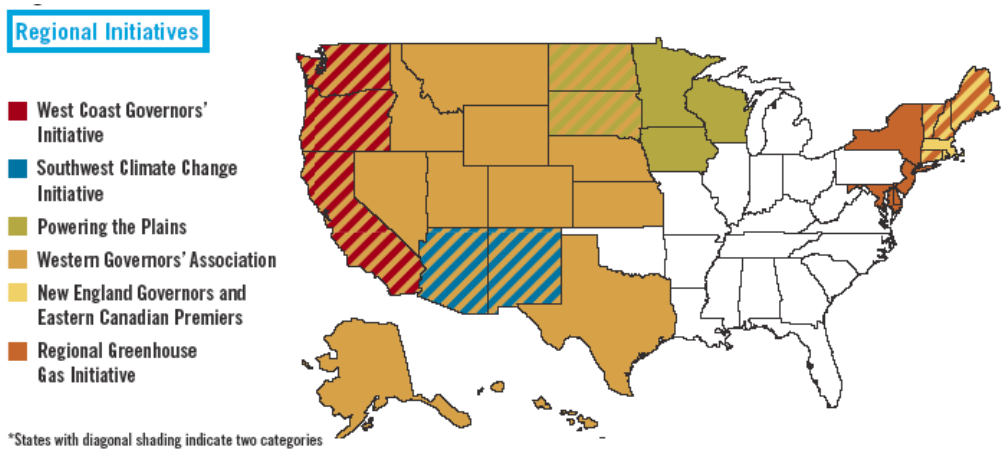

Figure 1. US Regional and State Initiatives to reduce Greenhouse Gases

Source: Pew Center on Global Climate Change (2007).

What is a Carbon Credit?

A carbon credit (C-credit) can be thought of as a tradeable permit that provides the holder the right to emit one tonne (i.e. metric ton) of carbon dioxide or other equivalent greenhouse gas.

How are other Greenhouse Gases Converted into Carbon Equivalents?

There are many different "greenhouse gases". The most common are carbon dioxide (CO_2), methane and nitrous oxide.

Global warming potentials (GWPs) are used to compare the abilities of different greenhouse gases to trap heat in the atmosphere (table 1). Carbon dioxide is given a base GWP of 1 and the GWPs of all other gases are reported in comparison to this base. The global warming potentials are used to convert other gases into units of CO_2 equivalent (CO_2e).

For example, using the information from table 1 below, 1 tonne of methane is equivalent to 23 tonnes of CO_2 i.e. 23 tonnes CO_2e. Most carbon markets trade credits specified as tonnes of CO_2e.

What is Cap and Trade?

The Kyoto protocol and the Chicago Climate Exchange use a cap and trade system to encourage the reduction of greenhouse gas emissions. An absolute limit (a cap) is set on total mass emissions for a group of sources for a fixed compliance period. The cap is then subdivided into C-credit allowances, each representing authorization to emit a specific quantity of CO_2e emissions. The allowances are allocated to the participants in the program. During the compliance period, the sources must carefully measure and report total emissions. At the end of the compliance period, each source is required to surrender allowances to cover each tonne of CO_2e emitted, or face penalties and fines. Each emission source can design its own compliance strategy – emission reductions and

allowance purchases or sales – to minimize its compliance cost. And it can adjust its compliance strategy in response to changes in technology or market conditions without requiring government review and approval.

Table 1. Global Warming Potential of Major Greenhouse Gases

Gas	**Global Warming Potential**
Carbon Dioxide	1
Methane	23
Nitrous Oxide	296
HFC[1]-23	12,000
HFC-125	3,400
HFC-134a	1,300
HFC-143a	4,300
HFC-152a	120
HFC-227ea	3,500
HFC-236fa	9,400
Perfluoromethane (CF_4)	5,700
Perfluoroethane (C_2F_6)	11,900
Sulfur Hexafluoride (SF_6)	22,200

[1]HFC = Hydroflourocarbons

Source: Intergovernmental Panel on Climate Change (2001).

Carbon credit transactions will involve the purchase of emission rights from those with the technical and economic ability to reduce greenhouse gas emissions at low cost. Those emitters with high costs of emissions reductions will purchase C-credits to offset their emissions.

Operators that have not used up their allowances can sell the unused portion as C-credits, while businesses that are about to exceed their quotas can buy the extra allowances as C-credits, privately or on the open market. As demand for energy grows over time, the total emissions must still stay within the cap, but it allows industry some flexibility and predictability in its planning to accommodate this.

By allowing allowances to be bought and sold, an operator can seek out the most cost-effective way of reducing its emissions, either by investing in 'cleaner' machinery and practices or by purchasing C-credits from another operator. Trading of C-credits between buyers and sellers establishes the market price per C-credit. If it is cheaper for an emitter of greenhouse gases to buy a C-credit from another company rather than controlling additional emissions, they will buy credits. A seller will want to sell credits if they can reduce greenhouse gas emissions or sequester additional C at a cost that is less than the price of the C-credit. Emissions trading transforms the “right to emit a pollutant” into a tradable good and creates economic incentives for emissions reduction.

An example of a cap and trade system is shown in figure 2.

How are Credits Created?

Credits can be created in MANY different ways. Commonly seen activities include switching from greenhouse gas intensive fuels in production processes; methane capture at land fills; carbon sequestration in agricultural soils and forest soils and biomass, among many other possibilities. The number of C-credits a firm may have to sell depends on

how much they reduce their emissions of greenhouse gases from a previous base level or increase their rate of carbon sequestration.

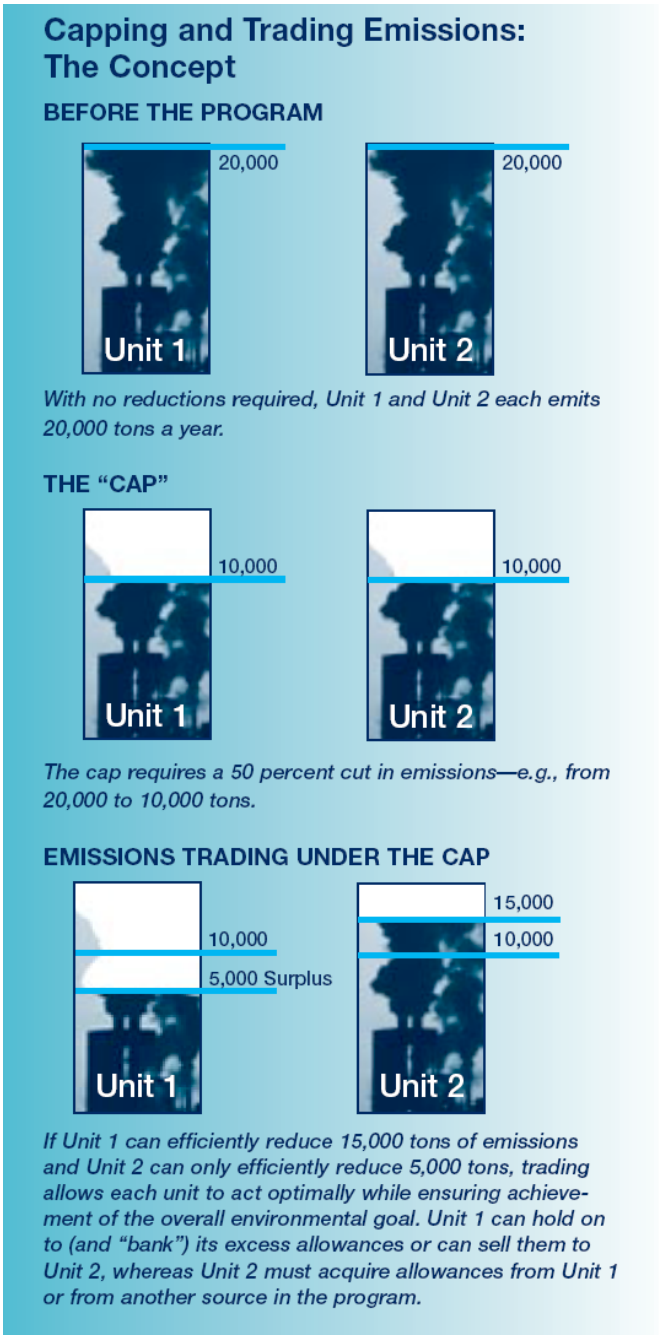

Figure 2. Concept of Cap and Trade.

Source: EPA (2002).

Are the Rules for Credit Creation the same between the European Market and the US Market?

The standards and rules for credit creation are not the same between the European Emissions Trading Scheme (EU-ETS) and the voluntary market in the US on the Chicago Climate Exchange. The rules for credit creation are more stringent on the EU-ETS market. Credits sold ion the EU-ETS must result in real net reductions in greenhouse gases. The Chicago Climate Exchange is a voluntary pilot market, the requirements for credit creation are less stringent and in part reflect the fact that one of the purposes of this market was to show the concept can work within the US.

Why are Prices different between the European Market and Chicago Climate Exchange?

Prices within the European market are considerably higher than those on the Chicago Climate Exchange. Figure 3 shows prices on the Chicago Climate Exchange.

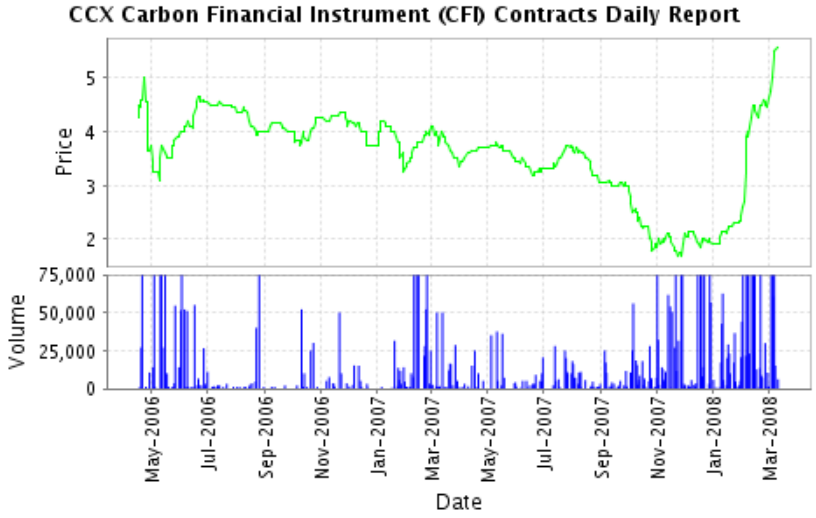

Figure 3. Daily prices for Carbon Credits on the Chicago Climate Exchange.
Source. http://www.chicagoclimatexchange.com/

During 2007, prices for carbon credits on the CCX ranged from a low of a little under $2 per credit to a little over $4 per credit. During the same period, prices on the EU-ETS ranged between $20 per credit to more than $30 per credit.

There is no trading between the Chicago Climate Exchange and the European market because the US does not participate in the Kyoto Protocol. In addition, as noted in an earlier section, the credits sold on the two markets do not conform to the same standards. Differences in the demand for, and supply of C-credits result in different market prices. Table 2 lists some factors that may account for the price differentials.

Table 2. Factors affecting C-credit Demand and Supply

	Carbon Credit Market Impacts		
Demand and Supply Factors	Demand Effect	Supply Effect	Price Effect
GHG and Energy Policy			
GHG reduction rules targets	I		I
Per-credit subsidy for credit purchase	I		I
Clean Development Mechanism	D		D
Clean Development Mechanism		?	?
Increased energy use efficiency	D	I	D
Subsidies for reduction or sequestration		I	D
Restrictions on credit production		D	I
Energy Prices			
Use of non-carbon based energy	D		D
Relative price increase of carbon intensive energy	D	I	D
Relative price decrease of carbon intensive energy	I	D	I
Technology and Input Cost			
New energy and GHG efficient technology	D		D
Subsidies and tax credits for adoption	D		D
Lower cost reduction technology		I	D
Higher cost reduction technology		D	I
Lower input costs of reduction or sequestration		I	D
Higher input costs of reduction or sequestration		D	I
Demand and Profitability of Carbon Neutral Products			
Increase in demand	I		I
Decrease in demand	D		D
Relative increase in profitability		D	I
Relative decrease in profitability		I	D
Climate Changes			
Increased carbon based energy demand	I		I
Decreased carbon based energy demand	D		D
Productive Capacity of Agriculture			
Declining capacity to sequester GHG		D	I

D= Decrease, I = Increase

I=increase
D=decrease
?=not enough information

Source: Developed from information within Williams, Peterson and Mooney (2005).

Information Sources used for this Document

EPA, Office of Air and Radiation. 2002. Clearing the Air. EPA-430F-02-009. www.epa.gov/airmarkets (May).

EPA. 2003. Tools of the Trade: A Guide to Designing and Operating a Cap and Trade Program for Pollution Control. EPA430-B-03-002.

Intergovernmental Panel on Climate Change. 2001. *Climate Change 2001: The Scientific Basis*. Cambridge University Press, Cambridge, UK.

Pew Center on Global Climate Change. 2007. Climate Change 101: State Action.

Williams, J.R., J. M. Peterson, and S. Mooney. 2005. The Value of Carbon Credits: Is There a Final Answer? *Journal of Soil and Water Conservation*. 60(2):36A-40A.